

PROPORTIONALITY (VARIATION)

(PI) (4 MARKS)



$$\textcircled{\propto} \longrightarrow \textcircled{=K}$$

1) y is directly proportional to x	$y \propto x$	$y = Kx$
2) y is inversely proportional to x .	$y \propto \frac{1}{x}$	$y = \frac{K}{x}$
3) y is directly proportional to <u>square of x</u>	$y \propto x^2$	$y = Kx^2$
4) y is inversely proportional to <u>cube of x</u>	$y \propto \frac{1}{x^3}$	$y = \frac{K}{x^3}$
5) y is inversely proportional to <u>cube root of x</u>	$y \propto \frac{1}{\sqrt[3]{x}}$	$y = \frac{K}{\sqrt[3]{x}}$

Q. y is inversely proportional to x^2

Given that when $x=2$, $y=9$.

(i) Find the formula relating x and y

(2)

$$y \propto \frac{1}{x^2}$$

$$y = \frac{k}{x^2}$$

$$9 = \frac{k}{2^2}$$

$$9 = \frac{k}{4}$$

$$k=36$$

$$y = \frac{36}{x^2}$$

(ii) Find y when

$x=5$.

(2)

$$y = \frac{36}{x^2}$$

$$y = \frac{36}{5^2}$$

$$y = \frac{36}{25}$$

ADVANCED

(1 MARK) (NO WORKING).

$$y \propto x^1$$

$\times 2 \leftarrow \times 2$

$\div 5 \leftarrow \div 5$

$$y \propto \frac{1}{x}$$

$\div 2 \leftarrow \times 2$

$\times 5 \leftarrow \div 5$

$$y \propto x^2$$

$\times 4 \leftarrow \times 2$

$$y \propto \frac{1}{x^3}$$

$$\div 25 \leftarrow \div 5$$

$$\div 8 \leftarrow \times 2$$

$$\times 125 \leftarrow \div 5$$

Q: y is directly proportional to $y \propto x^3$
cube of x . $\times 27 \leftarrow \times 3$

What happens to value of y if
 x is tripled.
 $\times 3$

When x is tripled, y is multiplied by 27

Q: y is directly proportional to x^2 .

For a certain value of x , $y = 10$.

Find the value of y when this value
of x is doubled. $\times 2$ (1 mark).

$$y \propto x^2$$
$$\times 4 \leftarrow \times 2$$

$$x = \text{certain value} \longrightarrow y = 10$$

$$x = \text{doubled } (\times 2) \longrightarrow \underline{\quad \times 4 \quad}$$

$$\boxed{\text{New } y = 40}$$

(c) M is directly proportional to L^3 .

How many times larger is M when L is multiplied by 2?

$$\begin{array}{ccc} M & \propto & L^3 \\ \times 8 & & \times 2 \end{array}$$

Answer 8 times [1]

(b) p is inversely proportional to q .

It is known that $p = 15$ for a particular value of q .

Write down the value of p when this value of q is doubled.

Answer $p =$ [1]

$$p \propto \frac{1}{q}$$

$\div 2 \leftarrow \times 2$

$q = \text{Some value} \longrightarrow p = 15$

$q = \text{Doubled } (\times 2) \longrightarrow \div 2$

New $p = 7.5$

Physics

$$R \propto L$$

$$\times 3 \leftarrow \times 3$$

$$\div 5 \leftarrow \div 5$$

$$R \propto \frac{1}{A}$$

$$\div 2 \leftarrow \times 2$$

$$\times 5 \leftarrow \div 5$$

$$R \propto \frac{1}{\pi r^2}$$

If radius is doubled

$$\div 4 \leftarrow \times 2$$



29 y varies inversely as the square of x .

(a) When $x = 2$, $y = 9$.

Find the value of y when $x = 3$.

$$y \propto \frac{1}{x^2} \rightarrow y = \frac{K}{x^2} \rightarrow y = \frac{36}{x^2}$$

$$9 = \frac{K}{2^2}$$

$$K = 36$$

$$y = \frac{36}{(3)^2} = 4$$

Answer $y = \dots\dots\dots$ [2]

(b) When $x = n$, $y = p$.

Write down an expression for y , in terms of p , when $x = 2n$.

$$y \propto \frac{1}{x^2}$$

$$\div 4 \leftarrow \times 2$$

$$x = n \rightarrow y = p$$

$$\downarrow \times 2$$

$$x = 2n \rightarrow y = \frac{p}{4}$$

Answer $\dots\dots\dots \frac{p}{4} \dots\dots\dots$ [1]

- 12 y is inversely proportional to x .
The table shows some values of x and y .

x	3	4	q	n
y	20	p	5	m

- (a) Find p .

$$\begin{array}{l|l}
 y \propto \frac{1}{x} & y = \frac{60}{x} \\
 y = \frac{k}{x} & p = \frac{60}{4} \\
 20 = \frac{k}{3} & p = 15 \\
 k = 60 &
 \end{array}$$

Answer $p = 15$ [1]

- (b) Find q .

$$\begin{array}{l}
 y = \frac{60}{x} \\
 5 = \frac{60}{q} \\
 5q = 60 \\
 q = 12
 \end{array}$$

Answer $q = 12$ [1]

- (c) Express m in terms of n .

$$\begin{array}{l}
 y = \frac{60}{x} \\
 m = \frac{60}{n}
 \end{array}$$

Answer $m =$ [1]